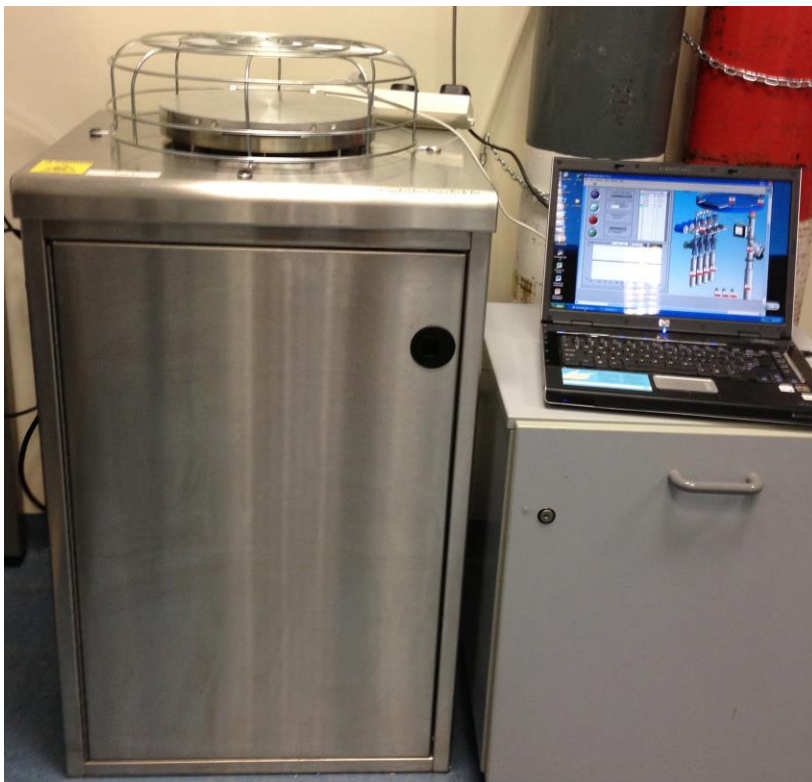


ALD SOP

This is a shortened version that focuses mainly on the operation. For more detailed instructions, please refer to the user manual “Cambridge NanoTech Savannah 100 AtomicLayer Deposition System”



1. Scope

1.1 This document provides operating procedures and requirements to deposit Al_2O_3 films with the Cambridge nanotech Savannah 200 Atomic Layer Deposition system.

1.2 System description

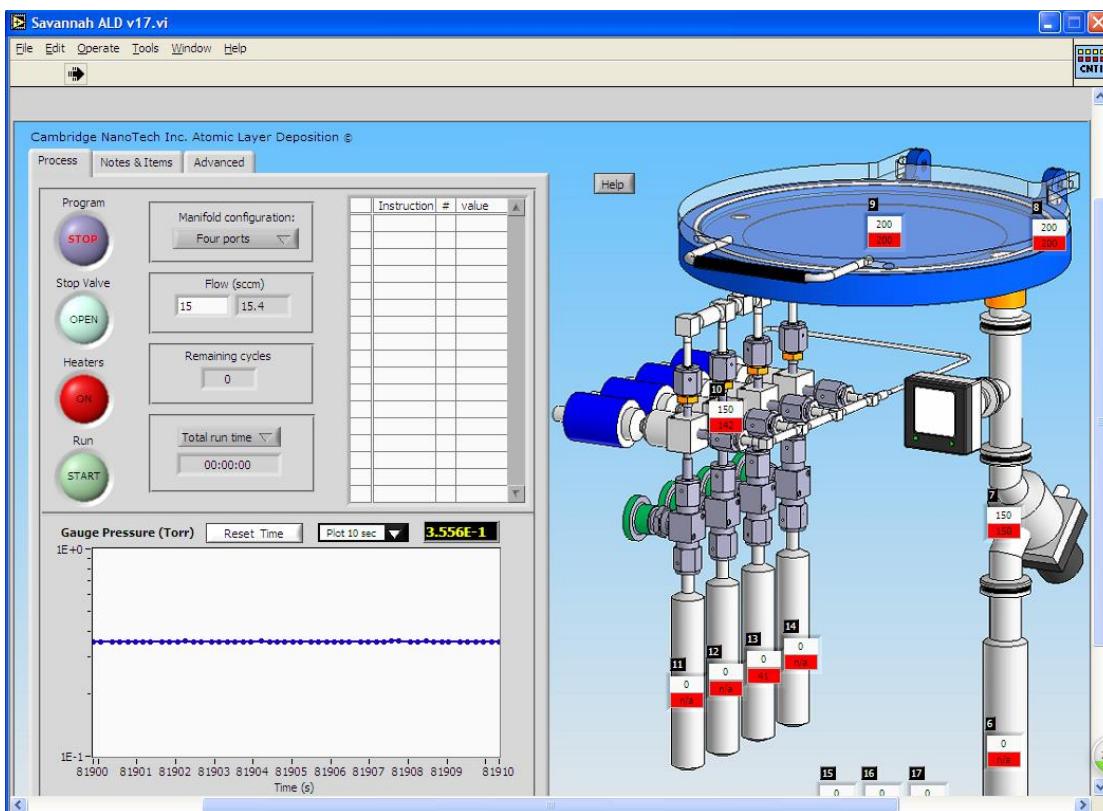
Atomic layer deposition (ALD) is a technique that allows growth of thin films with atomic layer precision. The ALD system in Nanomaterial and Nanodevice lab is capable of growth of many different material films including Al_2O_3 , TiO_2 , SiO_2 , TaO_2 , ZrO_2 , ZnO , Cu , Pt and Ru .

2. Before starting: Important note

- 2.1 You have to be authorized by Dr. Tang and properly trained by Dr. Tang's group member before operate the system.
- 2.2 TMA is pyrophoric and ignites when in contact with the air. Never remove TMA source.
- 2.3 The chamber lid and the walls are **HOT!** Use care when opening the chamber. Do not place any flammable materials on or near the ALD machine.

- 2.4 The chamber lid cannot be lifted if the chamber is cold. The temperature of the chamber outer heater should be set to at least 80 °C.
- 2.5 Do not put in materials that will outgas. Do not use a substrate having carbon tape. Do not use vacuum grease on your substrate or in the chamber.
- 2.6 System is intended to have the pump running, nitrogen flowing, and heaters on at all times, even when idle.
- 2.7 If restarting the system after it has been cold, e.g. following a power outage or maintenance shutdown, warm up the system first and follow the out-gassing procedure completely as described in the system manual.
- 2.8 In case that either of the precursors is running out, indicated by the disappearance of pulses during the running cycles, contact Dr. Tang for replacement. Do not attempt to change precursors by yourself.
- 2.9 The largest wafer size supported is 8" circular.
- 2.10 Always set the center heater to 150 °C and the outer heater to 150 °C after you finish the growth.

3. Software user interface



Buttons:

Program – Stop the Labview program

Stop Valve – Open and close the stop valve to the pump

Heaters – Turns all the heaters ON/OFF

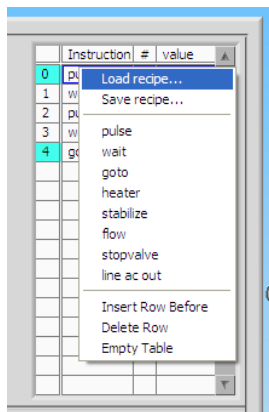
Run – Start/abort deposition



Receipt Area:

Cycle matrix – Programming of the cycle recipe.

Right click this area will open a menu for open/save/edit receipt:



4. Operation instruction

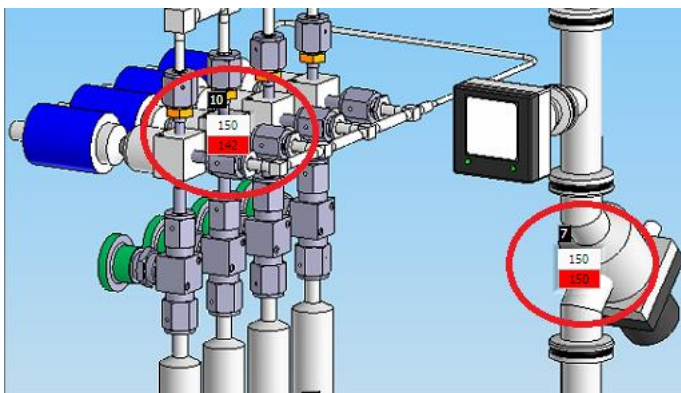
Load/Unload

- 4.1 Close the stop valve and set the flow rate to 100 sccm to vent the chamber. Only vent when system hot (chamber $>80^{\circ}\text{C}$), at lower temperature the lid will not open. Leave system vented for as short a time as possible.
- 4.2 Wait for the lid to rise slightly from the chamber (It will take a few minute, do not trust the gauge pressure). Please be patient, it is important to wait for the chamber to reach atmospheric pressure to preserve the integrity of the **very expensive O-ring**.
- 4.3 Lift the lid and place your sample in the center of the chamber. Close the lid.
- 4.4 Open the stop valve to pump down the chamber. The base pressure should be less than 1 Torr, depending on the flow rate

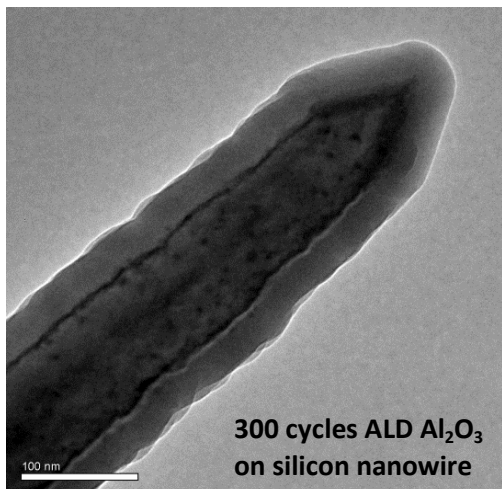
Growth run – Continuous flow mode (recommended)

- 4.5 Pump down the reactor chamber by opening the stop valve after loading sample. Set the flow rate to 15sccm.
- 4.6 Make sure all heaters are set to the desired temperatures.

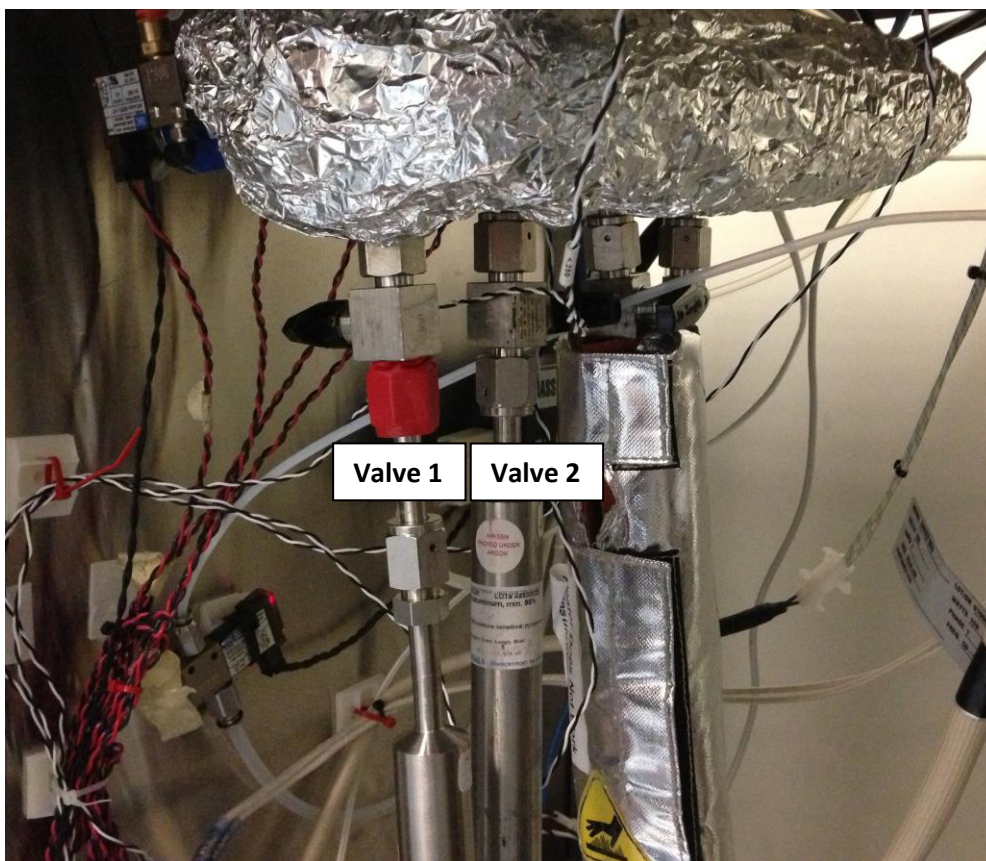
Note: Heater 7 and 10 has to reach 150°C before deposition can be started, otherwise you will damage the system quickly.



- 4.7 Right click the receipt area and load receipt: “Al₂O₃ 200C” from Jinyao’s folder (the chamber temperature should be set to 200°C).
- 4.8 This receipt is calibrated to for 0.11nm/cycle Al₂O₃ deposition.



- 4.9 Open the machine case and open the mechanical valve of 1 and 2 (water and TMA)



- 4.10 Click Start run in the run cycle area. You can see the pulses in the pressure plot area.
- 4.11 After the run is over, vent the system by set flow rate to 100sccm and remove your sample. Close the lid and pump down with flow rate set to 15 sccm.
- 4.12 Close mechanical valve 1 and 2. Run the same receipt for 10 cycles. Let the system idle. Write down your process on the log book.